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## A JUNIOR HIGH SCHOOL COURSE IN MATHEMATICS.\*

BY EMILY RENSHAW.

In attempting to formulate any course, or program of study, two dominant thoughts must guide, direct and mould its formation. First the definite aims, the definite object of the proposed course; and second, the selection and arrangement of such subject matter as will, at least, approximately realize those aims and ideals.

In planning a curriculum in mathematics for the junior high school, not only the above features were considered, but also the adjusting any course decided upon to the mathematical requirements of the senior high schools, so the pupils entering those schools from the junior high school need not be handicapped mathematically. To construct a program of study that would satisfy all requirements of both senior high schools was found to be impossible as each school emphasizes a different mathematical phase in the freshman year. And, may I suggest here parenthetically, if, in the near future, some steps could be taken for a closer coördination of interests of the various departments of the different high schools, without impairing the efficiency or ideals of any school, it might result in the arrangement of a course that would remove those differences that now tend to embarrass pupils transferred from one school to another.

It was further found necessary, in justice to pupils admitted to the junior high school and transferred to elementary schools, to incorporate into the course much of the material found in the seventh and eighth grade courses in mathematics.

What are the mathematical aspirations of the junior high school; what are the aims, the object, the ideals toward which it aspires?

The school consists of the seventh, eighth, and ninth grades,

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the pupils of which range in age from twelve to sixteen years and over. That means that the junior high school receives them at that critical, but interesting age of adolescence; the age of extreme self-consciousness; the age of excessive sensitiveness; the age when reason is demanding things in terms of life; the "whys" are demanded for statements that formerly were accepted indifferently. It is the age that insists that school activities be linked up with life, and any course that fails to take cognizance of these characteristics and adheres to the bare formalism of subjects fails irrevocably and cannot justify its existence.

So the aims and interpretations of the course are to show the boys and girls that mathematics is not an exclusive subject reserved for the favored few, but one that is mightily broad and is vitally necessary to success in the struggle for existence. The plumber, the carpenter, the painter, the builder, the salesman, the engineer, the business man, the clerk, the bookkeeper, the cook, the dressmaker, the homemaker, must have clear mathematical ideas to be successful and efficient.

While in no way discounting the efforts that tend to develop the pleasure and satisfaction that undoubtedly follow the solution of complicated problems, and while in no way ignoring the disciplinary and cultural advantage of mathematics, the junior high school undoubtedly emphasizes its utilitarian value, and while so doing attempts to develop clear reasoning, concise statements and accuracy of expression.

In the seventh A, the fundamental operations are reviewed for accuracy, speed and number combination; fractions are taken and applied in the most practical way; decimals are reviewed. Percentage and its various applications, profit and loss, commission, trade discount, taxes, interest, open a wide field for problems that link up with life.

In the seventh B, involution is introduced, preliminary to the teaching of square root. The measurements most commonly used, inches, square inches; feet, square feet; yards, square yards; miles and acres are subsequently employed in the mensuration that follows. This includes the dimensions and area of the geometric figures, square, rectangle, triangle and circle. Problems correlating this work with everyday activities; such

as, papering, plastering, carpeting, painting, paving, as well as with the work of the department of arts and shop are constantly presented for solution. The mere formal solution is not accepted in the performing of any of the above problems unless accomplished by some expression of the mode of procedure applicable in each case.

The eighth A continues the development of the geometric sense by introducing cubic measure and its practical application. In each stage of the work, geometric construction goes hand in hand with the development of each new geometric idea.

The latter half of the eighth A is again devoted to arithmetic. The purpose being to give a brief review of business arithmetic, laying special stress on business forms; such as, bills, statements, receipts, checks, pass books, deposit slips. The various kinds of promissory notes are also reviewed and the effect of the different kinds of endorsements is taught in the most practical way. Later the many ways of saving money are discussed, and finally the pupil is made acquainted with the cash, personal and property, account. Pupils are encouraged to keep their own cash accounts no matter how small, and present them at stated times to their teachers for criticism.

This is the most popular part of our course in arithmetic. Why? Because it is perfectly obvious to the pupil that the thing he is studying is of vital importance to the business world—the world of work, with which he is most familiar, and into which he pictures himself as eventually becoming a part.

As algebra is introduced in the eighth B, the first month or more is devoted to presenting such type of work as will awaken the algebraic sense, and develop the algebraic method of thinking. To bridge this transition stage, simple formulas with numerical substitution as applied to business and mensuration are employed. A carefully selected type of problem connecting arithmetic and geometry with algebra is extensively used in this preliminary work. Checking is emphasized. Later the fundamental operations of algebra are taught ending in this grade with special products.

The ninth grade, or freshman year of the senior high school, introduces factoring, fractions, fractional equations and graphs. In the latter half of this year, or ninth B, simultaneous equa-

tions, graphs, square root, radicals, surds and quadratic equations are the requirements.

In passing from one grade to another in the junior high school, promotions are made by subjects, and the arrangement of the roster is such as to group children in classes according to ability. This plan permits the presentation of minimum essentials in mathematics to those pupils below grade, while the minimum essential plus the additional requirements are given to the normal pupil and those above grade.

Have the aims embodied in this course been realized? No; all that was aimed for, all that was hoped for has not been accomplished, and that for several reasons. One is the time element. While some junior high schools not only advocate but embody in the arrangement of their roster three mathematics periods a week, the Philadelphia Junior High School provides for four periods of forty minutes each. This is a shorter period than that devoted to the same subject either in the elementary or higher schools. Again, the junior high school has not had the opportunity to work out the full effect of any course on any one set of pupils. Next June a year, the first class that really has received the entire benefit of the junior high program of study will enter the senior high schools.

It is really too soon to judge definitely or finally as to the efficacy of any junior high aims as portrayed in its curriculum. The school itself is a wonderful experiment. We are still applying tests, but hope, in the near future, to show that the junior high school—its ideals and their realization—is one of the most important adjuncts to the educational system of Philadelphia.

Our program of study is not permanent; at any time that which proves itself inadequate or non-essential will be readily replaced by that which is helpful and necessary. The ninth grade portion of our outline of study presents many features that were reluctantly recognized and accepted. The algebraic content of this part of the course is too great to secure clearness of thought and facility and accuracy of operation. Time will not permit the drill necessary to obtain these results. Yet the ground must be covered in order that our boys entering the senior high school be not at a disadvantage; and in emphasizing these algebraic requirements for the boys, the girls are forced

later in the senior high school to make up work not accomplished in the freshman year. We know the course is not perfect.

As a large percentage of our pupils select the commercial course in continuing their studies in the senior school, it is a debatable question whether so much time should be devoted to that aspect of mathematics that will not be of material advantage in the future. "Then why not have elective courses in the junior high?" you ask. That is also a question worthy of discussion, but for the present, it is thought that the province of the junior high is to give the pupil a general survey of all courses—academic, commercial, domestic, and then let him or her specialize in the senior school. If this is the true interpretation, then the ninth grade program of study is not ideal, and its inconsistencies and wrongly directed energies can only be rectified by the getting together of all interested in this problem and working out a plan that embodies those features which will harmonize the educational aspirations and aims of the schools into whose care these children are committed.

So we are not irrevocably committed to any set course. Any time we are willing to rearrange in part or entirety if, by so doing, we administer to the welfare of the pupil.

But in spite of any shortcomings the course may reveal on close analysis, this we feel we are accomplishing: The pupil who formerly thought mathematics beyond his ken, a subject into whose realm only few entered, has discovered that it really has something for him, that is, really does bear on life's interests, and so he is approaching his mathematics room perhaps reluctantly, but half willing to be led; the mediocre pupil has seen much that so arouses his interest that occasionally he passes from the class of mediocrity into the class bright; that fortunate pupil who some day may become an adept in mathematics insight, discovery and solution has ample food to feed his genius.

As a class passes into a room, the mathematics teacher is confronted with two big interests—the subject and the pupil, but the greater of these is the pupil.

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